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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/933,304	08/20/2001	Peter Lahnor	6521/83562	5680

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Gerald T. Shekleton, Esq.
Welsh & Katz, Ltd.
22nd Floor
120 S. Riverside Plaza
Chicago, IL 60606

EXAMINER

VINH, LAN

ART UNIT	PAPER NUMBER
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1765

DATE MAILED: 05/17/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/933,304	LAHNOR ET AL.	
	Examiner	Art Unit	
	Lan Vinh	1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 25 February 2004.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 2-8 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 2-8 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☒ Certified copies of the priority documents have been received in Application No. 09/933,304.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 2, 3, 4, 5, 6, 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Abe (US 6,455,430) in view of Li et al (US 6,331,479)

Abe discloses a method of embedding contact hole by damascene method and CMP (Chemical mechanical polishing). This method comprises the steps of:

forming a groove/via 109 in the dielectric layer 107 (fig. 1D),

forming a metal layer (titanium) 111/liner over the whole surface/area on the dielectric layer 107 and groove/contact via 109 (col 2, lines 64-65; fig. 1E), depositing a metalization layer 113 of copper over the whole surface/area on the dielectric layer 107 and in the groove 109), forming a carbon film 108 (claimed auxiliary layer) on the dielectric layer 107 between the liner 111 and the dielectric layer 107 surrounding the contact via 109 (col 2, lines 42-45, fig. 1E), performing a CMP process to remove the metal layer 113 on the layer 111/liner and cut/perforate the layer 108/auxiliary layer (col 3, lines 10-16, fig. 2A and 2B shows the carbon film 202/auxiliary layer is penetrated/perforated, fig. 1F also shows the layer 111 is cut/perforated), the polishing process stops on the dielectric layer as seen in fig. 2C. In one embodiment of Abe, fig.

4C shows the perforated layer 402/auxiliary layer with a portion of layer 402 is removed, fig. 4C also shows the liner layer, inside the connection 405, is lifted off from the dielectric layer 401.

Unlike the instant claim inventions as per claims 3, 8, Abe does not disclose perforating said liner and said auxiliary layer to form a plurality of perforations/using the layer 108/auxiliary layer partly as a hard mask for the patterning preceding the dry etching.

However, Li discloses a method for forming copper damascene interconnect comprises the step of using the perforated carbon-containing layer 104 (having a plurality of perforations as seen in fig.12), deposited between a liner 114 and dielectric layer 100, partly as a hard mask for the patterning preceding the dry etching (col 5, lines 36-67) which reads on using an auxiliary layer partly as a hard mask for the patterning preceding the dry etching.

One skilled in the art would have found it obvious to modify Abe method by perforating the layer 108/auxiliary layer to form a plurality of perforations and employing Abe's perforated layer 108/auxiliary layer as a hard mask for the patterning preceding the dry etching as taught by Li because according to Li the presence of perforated layer 104/hard mask layer protects the dielectric layer from damage due to plasma (col 6, lines 7-9, fig. 12)

Regarding claim 2, Abe discloses that the carbon layer 108/auxiliary layer having a thickness of 200 Angstroms (20 nm), which overlaps the claimed range of 20-100 nm.

The limitation of the auxiliary layer is composed of diamond-like carbon, as recited in claim 6, has been discussed above.

Regarding claim 4, Abe discloses that the carbon layer 108/auxiliary layer serves as a stopper in the polishing step (col 3, lines 25-28), which reads on detecting the auxiliary layer by an etching stop detection.

Regarding claim 5, Abe discloses the step of performing ultrasonic surface cleaning /wet chemical cleaning step after the etching step (col 4, lines 10-14)

3. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Abe (US 6,455,430) in view of Li et al (US 6,331,479) and further in view of Schwalke et al (US 5,726,094)

Abe as modified by Li has been described above in paragraph 2. Unlike the instant claimed invention as per claim 7, Abe and Li do not disclose using the carbon layer 108/auxiliary layer in conjunction with a CARL resist as bottom resist

However, Schwalke discloses a process for producing a diffusion region adjacent to a recess in a substrate comprises the step of using a layer 6 deposited between a dielectric layer 43 and liner 12 in conjunction with a CARL resist layer 14 as bottom resist (col 4, lines 26-45; col 5, lines 34-41 and fig. 12) which reads on using an auxiliary layer in conjunction with a CARL resist as bottom resist

Hence, one skilled in the art would have found it obvious to modify Abe and Li by using the auxiliary layer in conjunction with a CARL resist as bottom resist as per

Schwalke because according to Schwalke in order to structure the diffusion layer, a bottom resist layer is preferable applied to the diffusion layer (col 3, lines 10-18)

Response to Arguments

4. Applicant's arguments filed 2/25/2004 have been fully considered but they are not persuasive.

The applicants argue that there is no disclosure in Abe that his layer is perforated. This argument is unpersuasive because as seen in fig. 2A and 2B of Abe, carbon-containing layer 202/auxiliary layer is penetrated/perforated.

Applicants also argue that Abe does not recognize or suggest that the formation of the perforations in the auxiliary layer allows the resist to be undercut and more easily removed. This argument does not commensurate with the scope of claim 8 because claim 8 does not require that " the formation of the perforations in the auxiliary layer allows the resist to be undercut and more easily removed".

5. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not

mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Conclusion

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lan Vinh whose telephone number is 571 272 1471. The examiner can normally be reached on M-F 8:30-5:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571 272 1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



LV

May 13, 2004